GPS

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EVK-6R

u-blox 6 Evaluation Kit with Dead Reckoning

User Guide

Abstract

This document describes the components and usage of the EVK-6R Evaluation Kit and guides through the evaluation and testing of u-blox 6 based Dead Reckoning Technology.

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Document Information	
Title	EVK-6R
Subtitle	u-blox 6 Evaluation Kit with Dead Reckoning
Document type	User Guide
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Document status	Objective Specification

Document status information	
Objective Specification	This document contains target values. Revised and supplementary data will be published later.
Advance Information	This document contains data based on early testing. Revised and supplementary data will be published later.
Preliminary	This document contains data from product verification. Revised and supplementary data may be published later.
Released	This document contains the final product specification.

Contents

1 Specifications

1.1 Electrical specifications

Serial Interfaces	1 RS-232, 1 USB V2.0
Speed Pulses + FWD/BACKWD Signal	Voltage range: 4.5 to 12 V Galvanic decoupling circuit inside
Power Supply	9 to 24V[1]

Table 1: Electrical specifications

1.2 Mechanical dimensions

Length (excl. ON/OFF switch)	87 mm
Width	110 mm
Height	36 mm

Table 2: Mechanical dimensions

[1] Powering through the USB is not supported.

2 Getting Started

2.1 Evaluation kit content

Please check if the content of your Evaluation Kit consist of the following components:

- u-blox 6 GPS Dead Reckoning Evaluation Box
- 1 serial interface cable with RJ45 connectors
- 1 serial adapter RJ45 to DB9 female
- 1 USB cable
- 1 power supply adapter
- 1 active GPS antenna
- 1 CD ROM with u-blox evaluation software and USB driver

2.2 Installation

1. Connect the power adapter to the evaluation box and a power rail.
2. Connect one of the serial interface cables to port 1 or USB of the evaluation box and a personal computer running Microsoft® Windows 7, Windows Vista or Windows XP.
3. Connect the GPS antenna to the evaluation box and place the antenna at a location with a good view to open sky.
4. Connect odometer signal and the forward-backward signal (optional) to the evaluation box.
5. Enter the CD-ROM with u-blox EvalKit software to your personal computer. The installation software will automatically start and guide you through the installation process.
6. Power up the evaluation box.
7. Start the u-center GPS Evaluation Software and synchronize COM port and baudrate (refer to the u-center user's guide for more information).

2.3 Serial port default configuration

Parameter	Description	Remark
Port 1, Input	UBX protocol, NMEA at 9'600 Baud	
Port 1, Output	UBX and NMEA protocol at 9'600 Baud	Only NMEA messages are activated
USB, Input	UBX and NMEA protocol	
USB, Output	UBX and NMEA protocol	Only NMEA messages are activated

Table 3: Default configuration

3 Description

3.1 Front and rear panel of the EVK-6R Evaluation Box

Figure 1 and Figure 2 show the front and the rear sides of the Evaluation Box, showing the interface elements.

Figure 1: Front panel

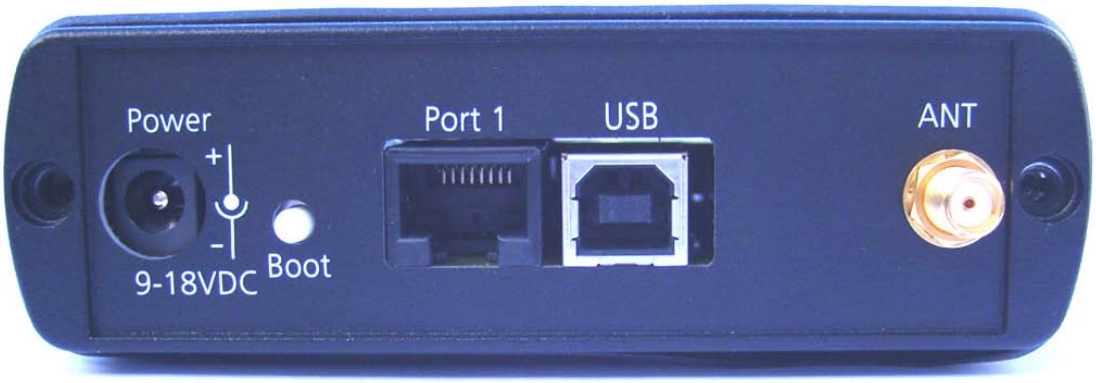


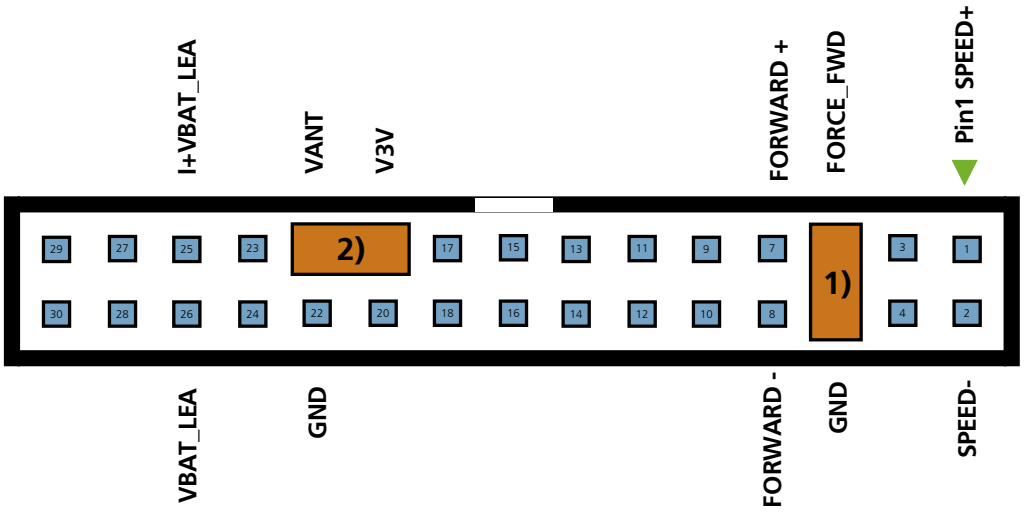
Figure 2: Rear panel

3.1.1 Service connector

The 30-pin connector with a pitch of 2.54mm on the front panel of the EVK-6R GPS Evaluation Box gives access to the most important signals from the Evaluation Kit. Extension boards or other interface electronics can be connected to this connector.

☞ **The power output of this connector is limited. In case of longer cable lengths for signals coming out of this connector, signals might have to be repeated or amplified. For further details refer to the electronic schematics in section 3.4.1.**

To use the EVK-6R Evaluation Kit, the jumpers have to be set according to Figure 3. This diagram depicts the "Service connector", including the pin assignment and jumper settings.



1) PIN5 - PIN6: Set direction to 'forward' if no direction signal available
2) PIN19-PIN21: Connect VANT with 3V to supply the active antenna

Figure 3: Service connector and pin assignment (front view)

Pin Nr.	Signal Name	Description	Signal Direction
1	SPEED+	Speedpulse Signal	Input
2	SPEED-	Speedpulse Signal	Input
3	N.C.	Not Connect	
4	N.C.	Not Connect	
5	FORCE_FWD	Forces Direction Signal to forward	Output
6	GND	Ground	
7	FORWARD+	Forward/ Backward Signal	Input
8	FORWARD-	Forward/ Backward Signal	Input
9 : 18	N.C.	Not Connect	
19	V3V	3V DC	
20	N.C.	Not Connect	
21	VANT	Bias voltage for active antenna	Input
22	GND	Ground	
23	N.C.	Not Connect	
24	N.C.	Not Connect	
25	I+VBAT_LEA	Service Pin to measure the Backup Battery Current	Output
26	VBAT_LEA	Backup Battery Voltage	Output
27	N.C.	Not Connect	
28	N.C.	Not Connect	
29	N.C.	Not Connect	Output
30	N.C.	Not Connect	Output

Table 4: Pin assignment of the "Service" connector

3.1.2 Reset button

The red button on the front panel of the EVK-6R GPS Evaluation Box is the reset button.

3.1.3 LEDs

On the front panel there are 4 LEDs to monitor the status of the GPS Evaluation Box. .

LED Name	Description
Tx1	Indicates data transmission on Tx1 (transmission to the host)
Rx1	Indicates data reception on Rx1 (reception from the host)
Power	Indicates if power is applied to the GPS Evaluation Box
TPulse	Timepulse Signal (pin P28 of LEA-6R)

Table 5: Features of the LEDs on the Evaluation Box

3.1.4 On/Off switch

There is a power switch on the right side of the front panel of the Evaluation Box.

3.1.5 Power supply connector

The power supply connector is a DC power supply jack with a diameter of 2.1mm. The matching connector has to have an inner diameter of 2.1mm and an outer diameter of 5.5mm. According to the specification, the Evaluation Box works with a power supply voltage range from 9 to 24V DC, whereas the inner contact of the jack is the positive pole.

3.1.6 Boot button

The Boot button is non-functional on this evaluation kit.

3.1.7 Serial interface connector (RJ45/DB9)

An RS232 port is available on the GPS Evaluation Box. The pin assignment of the RJ45 connector is according to the EIA/TIA 561 standard for RS-232D.

RJ45	DB9	Name	Description	Direction
1	**9**	**RI**	Ring Indicator	Output
2	**1**	**DCD**	Data Carrier Detect	Output
3	**4**	**DSR**	DSR; for future use	Input
4	**5**	**GND**	Signal ground – there is no cable shield!	
5	**2**	**TxD**	Transmission Data to the host computer	Output
6	**3**	**RxD**	Receiving Data from the host computer	Input
7	**8**	**NC**	Not connected	
8	**7**	**NC**	Not connected	

Table 6: Pin assignment of the serial interface connector

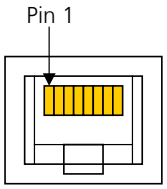


Figure 4: RJ45 connector pin order

3.1.8 USB

The EVK-6R features a USB V2.0 serial port as an alternative to the UART serial port. Powering through the USB is not supported.

3.1.9 Antenna connector

There is a SMA female jack on the rear side of the GPS Evaluation Box for connecting an active or passive antenna.

3.2 Active antenna

The EVK-6R EvalKit comes with an active GPS antenna with 5 m of cable. It is possible to connect various active and passive GPS antennas with a SMA connector to the GPS Evaluation Box.

☞ **The antenna biasing current can be measured by placing an ampere meter instead of the jumper on PIN19 and PIN21 of the Service Connector (see *section 3.1.1*).**

3.3 Cables and adapters

3.3.1 Power supply

The Power supply delivered in the EvalKit is a standard 12V/0.8A DC external device with a detachable power cord, which is available with power plugs for specific countries. The input range of the power supply is from 100 to 240 V AC within a range of 50 to 60 Hz.

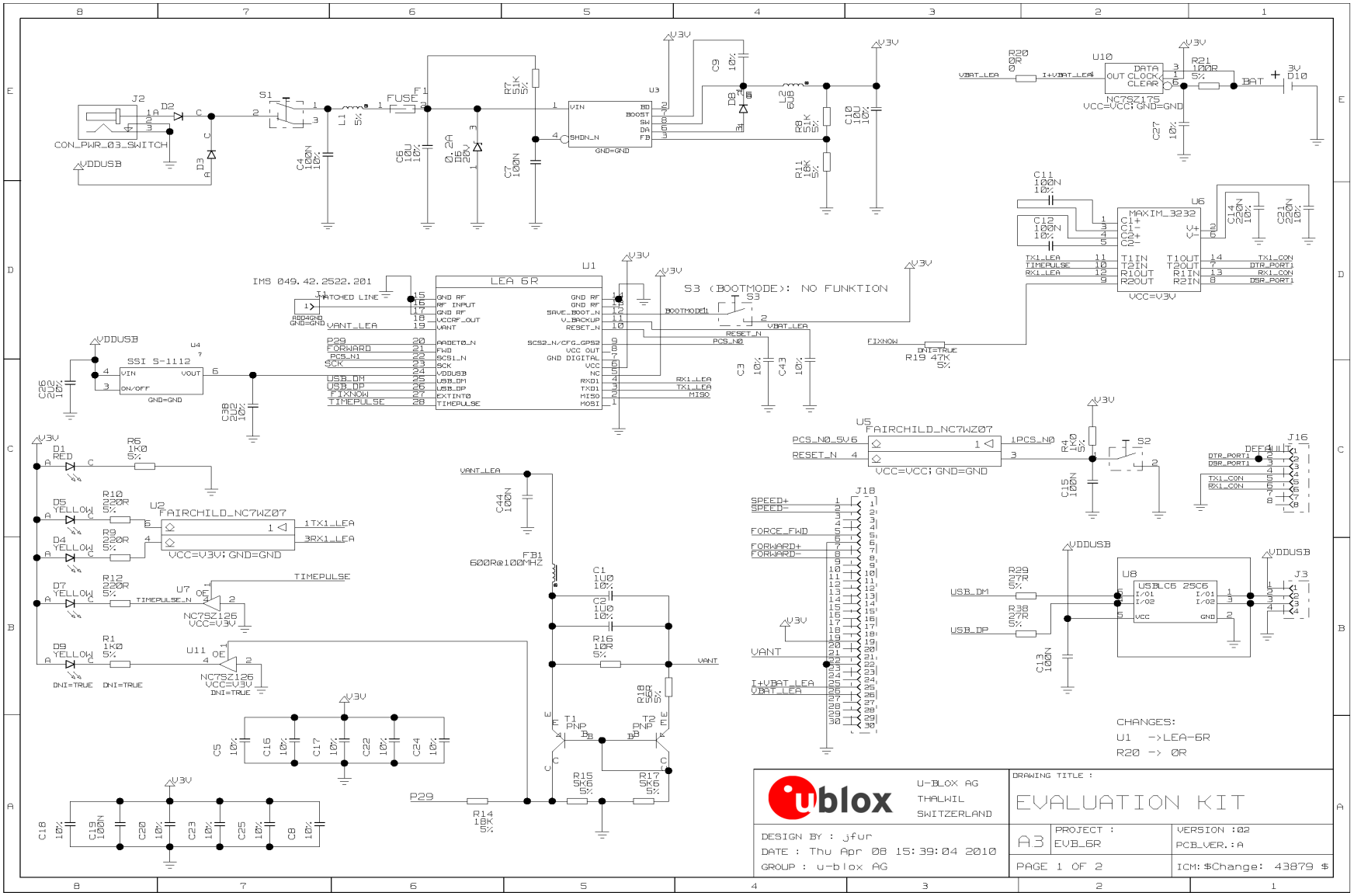
3.3.2 Serial interface cable

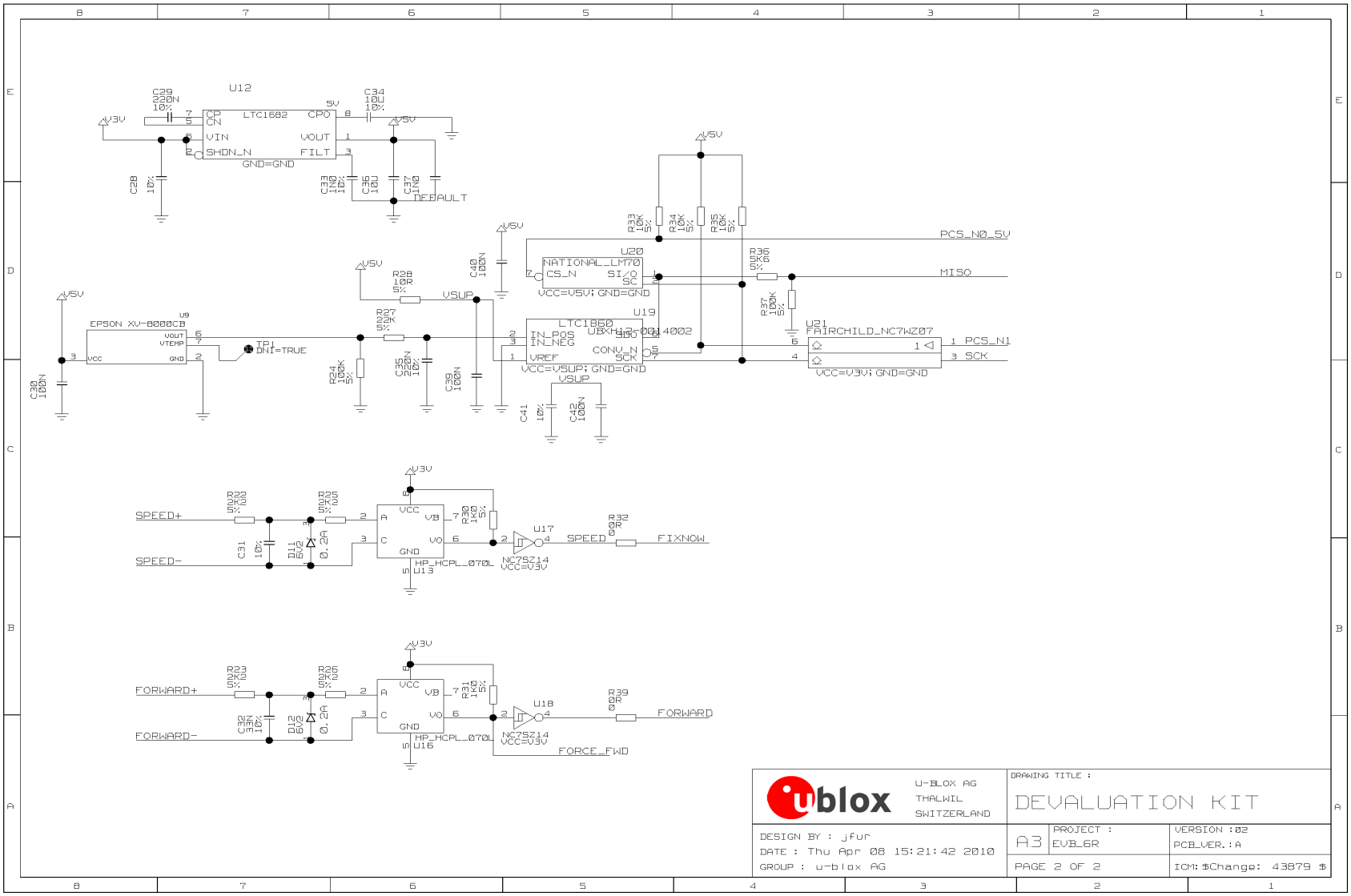
The EVK-6R EvalKit comes with one 8-pole "1:1" serial interface cable with RJ45 plugs at both ends. The maximal length of the cable depends on the quality of the cable and on the speed of the cable. Therefore a recommendation is given that the cable should not exceed 3m connected directly to the host PC.

3.4 Backup battery

The Backup Battery in the Evaluation Box is a 3V lithium battery of the type 2450N. This battery has a capacity of 540 mAh, which should last for approximately 1 year for storing GPS and calibration sensor data in the EVK-6R EvalKit.

3.4.1 Schematics




U12
LTC1682
GND=GND
DEFAULT
U20
NATIONAL_LM70
VCC=V5V; GND=GND
U19
LTC1860
VCC=V5UP; GND=GND
U21
FAIRCHILD_NC7WZ07
VCC=V3V; GND=GND
PCS_N0_5V
MISO
PCS_N1
SCK
VSUP
EPSON XV-8000CB
DNI=TRUE
SPEED+
SPEED-
FORWARD+
FORWARD-
HP_HCPL_070L
NC7SZ14
SPEED
FIXNOW
FORWARD
FORCE_FWD
U-BLOX AG
THALWIL
SWITZERLAND
DRAWING TITLE :
DEVALUATION KIT
DESIGN BY : jfur
DATE : Thu Apr 08 15:21:42 2010
GROUP : u-blox AG
A3
PROJECT : EVB_6R
VERSION : 02
PCB_VER. : A
PAGE 2 OF 2
ICM: $Change: 43879 $

4 Troubleshooting

My application (e.g. u-center) does not receive anything

Check if the Evaluation Box is powered and make sure the serial cable is properly connected to the Evaluation Box and the PC. By default the Evaluation Box outputs NMEA protocol on Serial Port 1 at 9600 Bd, or on the USB.

My application (e.g. u-center) does not receive all messages

Make sure the baudrate is sufficient. If the baudrate is insufficient, GPS receivers based on u-blox 6 GPS Technology will skip excessive messages. Some serial port cards/adapters (i.e. USB to RS232 converter) frequently generate errors. If a communication error occurs while u-center receives a message, the message will be discarded.

My application (e.g. u-center) looses the connection to the GPS receiver

u-blox 6 GPS Technology and u-center have an autobauding feature. If frequent communication errors occur (i.e. due to problems with the serial port), the connection may be lost since u-center and the GPS receiver will autonomously try to adjust the baudrate. Do not enable the u-center autobauding feature if the GPS receiver has the autobauding flag enabled.

Some COM ports are not shown in the port list of my application (e.g. u-center)

Only the COM ports that are available on your computer will show up in the COM port drop down list. If a COM Port is gray, another application running on this computer is using it.

The EVK-6R does not meet the TTFF specification

Make sure the antenna has a good sky view. Obstructed view leads to prolonged startup times. In a well-designed system, the average of the C/No ratio of high elevation satellites should be in the range of 44 dBHz to about 50 dBHz. With a standard off-the-shelf active antenna, 47 dBHz should easily be achieved. Low C/No values lead to a prolonged startup time.

The position is off by a few dozen meters

u-blox 6 GPS Technology supports different datums. By default, it starts up with the WGS84 standard GPS datum. If your application expects a different datum, you'll most likely find the positions to be off by a few dozen meters. Find out what kind of datum your application requires and configure the EvalKit accordingly. And don't forget to check the calibration of u-center map files.

The position is off by hundreds of meters

Position drift may also occur when almanac navigation is enabled. The satellite orbit information retrieved from an almanac is much less accurate than the information retrieved from the ephemeris. With an almanac only solution the position will only have an accuracy of a few kilometers but it may startup faster or still navigate in areas with obscured visibility when the ephemeris from one or several satellites have not yet been received. The almanac information is NOT used for calculating a position if valid ephemeris information is present, regardless of the setting of this flag.

In NMEA protocol, position solutions with high deviation (e.g. due to enabling almanac navigation) can be filtered with the Position Accuracy Mask. UBX protocol does not directly support this since it provides a position accuracy estimation, which allows the user to filter the position according to his requirements. However, the 'Position within Limits' flag of the UBX-NAV-STATUS message indicates whether the configured thresholds (i.e. P Accuracy Mask and PDOP) are exceeded.

With external power management, the TTFF times are much longer than specified

At startup (after the first position fix) the GPS receiver performs an RTC calibration to have an accurate internal time source. A calibrated RTC is required to achieve minimal startup time.

Before shutting down the receiver externally, check the status in MON-HW in field 'Real Time Clock Status'. Don't shut down the receiver if the RTC is not calibrated.

EVK-6R does not preserve the configuration in case of reset

u-blox 6 GPS technology uses a slightly different concept than most of the other GPS receivers do. Settings are initially stored to volatile memory. In order to save them permanently, sending a second command is required. This allows testing the new settings and reverting to the old settings by resetting the receiver if the new settings aren't good. This provides safety, as it's no longer possible to accidentally program a bad configuration (e.g. disabling the main communication port).

EVK-6R only reports 3D fixes

The internal sensor integrity check might reject sensor measurements due to gyro malfunction or missing speed pulses. Check the attached sensors (Gyro, Speed Signal), **reset all calibration data** in UBX-CFG-EKF and execute an initial calibration.

EVK-6R only reports a speed of 0km/h while driving

The EVK-6R may not recognize the speed pulses from the speed indicator. Check the speed signal attached (voltage level, signal type) and compare with the speed signal definitions. For more information consult the *LEA-6R System Integration Manual* [3].

4.1 Common Evaluation Pitfalls

- Parameter may have the same name but a different definition. GPS receivers may have a similar size, price and power consumption but can still have different functionalities (e.g. no support for passive antennas, different temperature range). Also, the definitions of Hot, Warm, and Cold Start times may differ between suppliers.
- Verify design-critical parameters; do not base a decision on unconfirmed numbers from datasheets.
- Try to use identical or at least similar settings when comparing the GPS performance of different receivers.
- Data, which has not been recorded at the same time and the same place, should not be compared. The satellite constellation, the number of visible satellites and the sky view might have been different.
- Do not compare momentary measurements. GPS is a non-deterministic system. The satellite constellation changes constantly. Atmospheric effects (i.e. dawn and dusk) have an impact on signal travel time. The position of the GPS receiver is typically not the same between two tests. Comparative tests should therefore be conducted in parallel by using one antenna and a signal splitter; statistical tests shall be run for 24 hours.
- Monitor the Carrier-To-Noise-Ratio. The average C/No ratio of the high elevation satellites should be between 44 dBHz and about 50dBHz. A low C/No ratio will result in a prolonged TTFF and more position drift.
- When comparing receivers side by side, make sure that all receivers have the same signal levels. The best way to achieve this is by using a signal splitter. Comparing results measured with different antenna types (with different sensitivity) will lead to incorrect conclusions.
- Try to feed the same signal to all receivers in parallel (i.e. through a splitter); the receivers won't have the same sky view otherwise. Even small differences can have an impact on the accuracy. One additional satellite can lead to a lower DOP and less position drift.
- When doing reacquisition tests, cover the antenna in order to block the sky view. Do not unplug the antenna since the u-blox 6 GPS Technology continuously performs a noise calibration on idle channels.

Related documents

[1] LEA-6 Data Sheet, Docu. No GPS.G6-HW-09004
[2] LEA-6/NEO-6 Hardware Integration Manual, Docu. No GPS.G6-HW-09007
[3] LEA-6R Integration Considerations Application Note, Docu. No GPS.G6-HW-10028
[4] u-blox 5/6 Receiver Description including Protocol Specification, Docu. No GPS-SW-09017
[5] u-center – User's Guide, Docu. No GPS-SW-08007

☞ For regular updates to u-blox documentation and to receive product change notifications please register on our homepage.

Revision history

Revision	Date	Name	Status / Comments
-	27/04/2010	tgri	Initial release

Contact

For complete contact information visit us at www.u-blox.com

u-blox Offices

North, Central and South America

u-blox America, Inc.

Phone: +1 (703) 483 3180
E-mail: info_us@u-blox.com

Regional Office West Coast:

Phone: +1 (703) 483 3184
E-mail: info_us@u-blox.com

Technical Support:

Phone: +1 (703) 483 3185
E-mail: support_us@u-blox.com

Headquarters
Europe, Middle East, Africa

u-blox AG

Phone: +41 44 722 74 44
E-mail: info@u-blox.com
Support: support@u-blox.com

Asia, Australia, Pacific

u-blox Singapore Pte. Ltd.

Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com

Regional Office China:

Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office Japan:

Phone: +81 03 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Korea:

Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com

Regional Office Taiwan:

Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com